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ABSTRACT

This report summarizes field work on Andra Island, Papua New Guinea, one of five community schools participating in the ongoing research and development efforts of the Indigenous Mathematics Project (IMP). It opens with an introduction to the site, the school setting, and the community setting. Background on the IMP teacher and the size of classes which participated in the study (grades 4 and 6) are noted; there is no separate grade 2 class as in other IMP sites. Curriculum implementation is then discussed in detail, including such difficulties as the speed with which notes could be made during class observations, the lack of some materials, the need to pursuade the IMP teacher to modify activities as necessary, the length of lessons, and the careful but limited use of IMP workbooks. Lessons and materials which were particularly effective or not so effective are described, with suggestions for improvement of IMP materials. Language use is then described, with the difficulties of documenting in three languages noted. Finally, there are sections on classroom interaction and on student interviews. The conclusion notes that both teacher and students found the IMP curriculum materials to be attractive and exciting, and the lack of a teacher's guide for the grade 6 program was most distressing for the teacher. (MNS)

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INDIGENOUS MATHEMATICS PROJECT

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ANDRA COMMUNITY SCHOOL
FIELD REPORT

Paula Levin

Working Paper 6
November 1980

THE INDIGENOUS MATHEMATICS PROJECT

This series of working papers and research reports has been published to provide a comprehensive source of documentation on research and development efforts associated with the Indigenous Mathematics Project. The Project was established in 1977 by the Government of Papua New Guinea to investigate various aspects of traditional mathematics development. During the first phase (1977–79) of the five year program, basic research in crosscultural cognitive development was carried out and indigenous counting, classification and measurement systems used throughout the country were documented. During the second phase of the project (jointly funded by the Department of Education and UNESCO), pilot instructional materials were developed and trialled. The intent was to assess the feasibility of utilizing complementary aspects of indigenous and Western mathematics as a basis for developing culturally relevant student materials, instructional aids and teachers' guides which reflect the practical constraints of the community school environment. The results of IMP work are intended to inform future curriculum development in an effort to provide more appropriate instructional materials and learning aids for Community Schools throughout Papua New Guinea.

Series Editor: Randall Souviney
Managing Editor: Jacquie Wathen

INDIGENOUS MATHEMATICS PROJECT

Field Report

ANDRA COMMUNITY SCHOOL

14 July - 22 August 1980

by

Paula F. Levin

Virginia Commonwealth University

This report summarizes field work carried out at one of five community schools in Papua New Guinea participating in the ongoing research and development efforts of the Indigenous Mathematics Project.

INTRODUCTION TO SITE

Transportation

From Lorengau I took a speedboat for the one hour trip to Andra Island. Most often, people make the voyage to and from Andra by motorized outrigger canoe which, depending on the size of the motor and the weather conditions, covers the distance Lorengau-Andra in 1 3/4 to 4 hours. People travel to neighbouring islands and to nearby villages on Manus mainland by paddling or by sailing their outrigger canoes.

Environment

Andra Island (Manus Province) is a small low island situated a few miles off the north-central coast of the island of Manus. It is one in a chain of small islands which parallel the north coast of Manus.

Housing and Supplies

During the IMP trialling period, I lived in a newly constructed, and as yet unoccupied prefabricated teacher's house. It stood in the "public" area of the island, as did the school, church, community club, aide post, and the other two teacher's houses (made of bush materials). While there were many small trade stores (canteens) on Andra, where one could purchase rice, kerosene, and other basic necessities, I needed to make trips to Lorengau for mail, major food purchases and banking. Andra has no two-way radio, so communication with the outside world depends upon making a trip to Lorengau by canoe. Presently there are four motor canoes on Andra, and at least one of these makes the voyage into Lorengau weekly or fortnightly. Fish is in abundance locally, and fruit and vegetables can be purchases at the twice-weekly markets on Manus mainland. Rain which drains off metal roofed

buildings into three large water tanks is the only source of potable water.

Initial Reactions

News of the IMP project and my impending arrival was broadcast on the Manus Provincial Education News Programme. Andra Islanders greeted me very warmly, and throughout my stay, they were helpful, friendly and interested in my work. I found Andra to be a very easy place to do research--the weather was pleasant, the fish plentiful, the mosquitoes scarce, and the people--bright, good humoured and interesting.

COMMUNITY ETHNOGRAPHY

SCHOOL SETTING

School Design and Construction

Andra Community School is housed in a building constructed in the late 1960 Measuring 28 m by 8 m, the building has a cement floor, walls of locally made cement blocks with glass louvered windows, and a corrugated iron roof which extended beyond the walls for several metres to provide a covered area along the front and back walls of the school building. Adjacent to the school is a building made of bush materials which is in a state of disrepair. It was last used as a full time classroom in 1977. Now the first graders play there on rainy days, and coconut husks from school projects are stored in a corner of the building. The school building itself is divided by cement block walls into three classrooms. At present one of these classrooms is divided by a pitpit wall, with half of the room used as a storage area.

History of Schooling on Andra The first formal schooling available to Andra people was in the Pidgin language learning schools opened by the

Catholic Mission at Bundralis on Manus mainland in the 1920s. More comprehensive schooling was provided for Andra Islanders following World War II, at which time boys were admitted to the mission school at Bundralis. In the 1950s some of the former mission school students returned to Andra and began giving classes in reading, writing, and arithmetic. Throughout the 1960s, children could complete only four grades of schooling on Andra; for grades 5 and 6, they had to attend the mission boarding school at Bundralis. With the opening of the new school building in the early 1970s, children no longer had to leave Andra to complete their primary schooling. In general, people in their 30s have completed 0-4 years of school, those in their 20s--4-6 years, and those in their teens--6 years and upwards. In the post-school age populations, men generally have completed more years of schooling than women, but the difference has been decreasing over time. Those students who want to and are permitted to (by school officials and by their parents) go on to attend secondary school most frequently attend Papitalai (Catholic) High School. A few students from Andra enroll at Manus Provincial High School, Lorengau Vocational School for boys, or the vocational school at Bundralis for girls. In all of these cases, Andra students board at school, returning to their home island during school holidays. Formerly known as Saint Theresa's Primary-T School, Andra Community School retains its affiliation with the Catholic Education Office in Lorengau.

Instructional Resources

Curriculum materials: The storeroom of the school appears fairly well supplied, given the rural setting of the school. Teachers take care to conserve the limited number of notebooks, and instruct the students to treat the textbooks gently. Although students are given a ruler and a few pencils each year, these items are continually in short supply in the classroom.

There is a small, but well used library of books and magazines in the Grade 6 classroom. The inventory conducted at the end of Term II lists as missing several syllabi and teaching materials for Grades 1, 4, and 6. Among these are Grade 1: First, Second and Third Activity Book; Grade 4: Language drill charts; and Grade 6: MACS-term 2, Using English pupils books 1-3, and the three Grade 6 readers.

Equipment: Andra Community School has no duplicating machine, much to the dismay of its teachers, who are working on ways of acquiring one. There is one broken typewriter and an unused small radio in the storeroom. For listening to the daily school broadcasts, the teachers prefer using their own portable radios, which they feel have better reception. The teachers themselves pay for the batteries used in the radios.

School Committee

Joe Puloh (Chairman)
James Lawein
Raphael Kalai Kidun (CLANS rep)
Stephen Lohai (LGC rep)
Francis Pangih (Church rep)
Julius Kakan (Truant officer)
Andrew Soonkalapus (APO)

Andra Teachers

	Yrs exp	Boys	Girls	Total	Mean age
Grade 1	6	22	17	39	8.79
Grade 4	\	15	7	22	11.95
	- 15				
Grade 6	/	14	15	29	13.31
	$\bar{x}$=10.95	T=51	T=39	T=90	$\bar{x}$=11.35

Andra C/S Daily Schedule

Time	Description
7:15	first bell-students sweep school area; wash themselves and eat breakfast
8:00	second bell; school opens
8:00-8:15	opening assembly
8:15-10:00	classes
10:00-10:30	recess (all grades)
10:30-noon	classes
noon-1:00	students return home for meal
1:00-3:00	classes
2:00-2:15	recess (Grade 1)
3:00	school ends for the day

Andra C/S Maths Daily Schedule

	Scheduled	Actual (during IMP trialling period)
Grade 4	150 min/week	200-225 min/week
Grade 6	150 min/week	200-225 min/week

Summary. For a rural school, Andra Community School is well-built and fairly well-equipped. Except during rainy weather, the elements do not intrude upon teaching and learning. During storms, the classrooms become dark, and the noise of rain on metal roofis at times deafening. Some logistic problems result from two instructors teaching three classes in two and one half classrooms, but the teachers themselves seem to have solved them by the co-ordination of their efforts. The design of the school building results in a constant loud background noise level throughout all the classrooms, especially during group recitation and radio broadcast times. However, the students and the teachers appear to find this not too distracting. Both teachers find that working at a relatively remote school presents difficulties in terms of access to materials--both the lack of functioning labour-saving devices (such as a duplicating machine) and the hardship in replenishing the stock of basic school supplies (such as missing syllabi, worn out books, notebooks, and pencils). The missing Grade 6 term 2 MACS syllabus is an example of this problem which relates directly to the IMP trialling study. Lacking this

syllabus, the Grade 6 teacher proceeded directly on to the term 3 materials during term 2. Thus, the grade 6 class had already completed a sizeable portion of that sequence before the beginning of term 3 and the start of the IMP trialling period.

COMMUNITY SETTING

Village Environment

Andra Community School serves all the villages on the island of Andra, as well as the village of Souh, located directly across from Andra on the Manus mainland. Since Andra is only 2 1/2 km in circumference, children have at most a ten minute walk to school. Children from Souh who attend Andra C/S live with their relatives on the island, returning to their parents' homes for holidays and occasional weekends. The preliminary results of the national census conducted in August 1980 show the population of Andra (excluding the Souh school children) to be 247. This figure may be an underestimation of as much as 10%, since a number of people were listed by the census takers as "visitors" to the island even though they have become established residents. (Visitors are not included in total population figures at the local level.)

People on Andra fish, both for subsistence and for market activity. Fish are either consumed, or are smoked and then sold or traded at the twice-weekly market on the mainland, or at the larger weekly market in Lorengau. The numerous trade stores on Andra do provide some cash income, but in fact most island "incomes" are remittances from children working at salaried jobs off-island.

Houses are made of local materials--sago palm siding with coconut

palm frond roofs, built either directly on the ground or up on wooden posts. Andra has a tropical climate with wet and dry seasons. Year round the temperature hovers around 30 degrees C. Even in the dry season, when potable water may be in short supply, thunderstorms arrive with some frequency.

Missionaries provided the first sustained western contact, with conversions to Catholicism taking place in the 1920s. A wide variety of western goods are well-integrated into Andra life--nylon fishing line, cloth material, kerosene lamps, plates, glasses, silverware, radios. Beyond these, access is limited by monetary resources. Generally those families which have children working off-island have a larger and more varied supply of western objects than those who do not.

While local government officials and mission people, such as nursing sisters stop at Andra, there are very few Europeans and almost no casual visitors or tourists who come to the island. Most western ideas and goods are introduced by Andra youths returning home from jobs in urban centres. While Andra people have little contact with non-Manusians in daily life, they are keenly interested in the world outside Manus. They are avid radio listeners, and younger people are voracious readers. The arrival of one million American military people during World War II had a profound impact on Andra life, both in terms of material goods and in terms of perceptions of the technological abilities of the West. Political authority on Andra rests with two elected officials--the council and the committee. Local court cases are adjudicated by village magistrates.

An informal census shows only four children--all girls--who are not receiving a primary education. In two of the cases, parents had decided to keep their daughters at home to help with work; in the other two cases, the girls had briefly attended school, did not like it, and were

not forced by their parents to return. These four girls make up about 6% of the school age population. This figure does not include those children who are sent to school at the age of 9 or 10, and therefore have not yet started school, or those who are 14 or 15 and have already completed Grade 6. The tendency toward delayed school entry seems strong on Andra, and is exaggerated by the fact that there is a Grade 1 class formed only every few years. In the current Grade 1 class, most children were born in 1970 and 1971, with very few of them born in 1972. The rest of the children born in 1972 who are not currently enrolled in school will not be able to start school for two or three more years, or until the next Grade 1 class is formed. At that time they may already be 9 or 10 years old.

Language Use in the Community

Andra tok ples (vernacular language) is the first language of all children raised on Andra. This language is mutually intelligible with a number of vernaculars of nearby islands and neighbouring villages. With the exception of young children and some old women, people on Andra speak Pidgin. English is spoken with varying degrees of fluency by all children over seven, most young adults, and some adult men. Everyday conversations among Andra people of all ages is carried on in tok ples. Pidgin is the language of church and, mixed with the vernacular, of community meetings. English is the language of school, with Pidgin used occasionally, and tok ples more rarely, in explanation or admonition. Children use English outside of the classroom for greeting teachers and conversing with visitors, and for singing hymns and jump rope rhymes.

Traditional Education and Socialization

People on Andra found it strange to be asked questions about how

children learn to speak various languages or how they learn to swim. Swimming and languages do not need to be taught; children learn by watching and imitating. Certain adult skills like basket weaving or canoe building are learned in part by adult instruction, but in larger part by observation. One man gave the following example of how a boy on Andra might learn to build a canoe. While his father is working on a canoe, the boy will watch and imitate on a piece of a log with a small knife. When he is a bit older, his father will tell him to get an axe and help the father on a regular-sized canoe, with the father correcting the son's mistakes as he goes along. Later, when the father "has faith", he may let his son work along, watching him from the side. Finally he lets his son go off and build a canoe by himself.

Family Structure and Traditions

With very few exceptions, monogamy is at present the preferred marriage pattern, along with virilocal (patrilocal) post-marriage residence. Men and boys of school age sleep in one of the men's houses, while women, girls and all children below school age sleep in the family's house. Generally children are raised by their biological parents, or by their mothers. However, there is some informal grandparent adoption of children, particularly in instances of the children's parents working off-island.

Community Life and School Performance

People on Andra strongly support their school. Teachers are respected members of the community. Villagers donate fish and other foodstuffs to the teachers, because the teachers "care for our children all day long." Chidlren attend school unless they are sick or hurt, and

attendance is near 100%. They arrive at school well-nourished and generally on time. Community leaders work closely with the headmaster to ensure that the school children (who on Andra are considered to be a clearly defined segment of the population with specific privileges and responsibilities) are well-behaved and properly treated. While few school children themselves have travelled widely, many have parents or older siblings who have been or are presently living off-island. This seems to provide continuing contact with and interest in the outside world. The current teachers on Andra grew up on a nearby island. Their ability to speak Andra tok ples, their kin ties within the Andra community, as well as their personal styles, result in their close involvement in community life.

IMPLEMENTATION STUDY

TEACHER HISTORY

The IMP teacher is a single woman in her early 20s, who comes from the neighbouring island of Hus. The first born of seven children, she attended primary school on her own island before attending the Catholic school at Bundralis (Grades 5 and 6), Papitalai High School (Grades 7 through 10), and two years of teacher training college in Rabaul, East New Britain. She taught for two years in the North Solomons Province before coming to Andra in 1977. From 1977 through 1979 she taught the same group of students as they passed from Grade 1 through Grade 3. In 1980 her teaching assignment has been Grade 1 which has 39 pupils. The IMP teacher has many relatives on Andra and is very well-integrated into the local community. She has applied for an in-service course in 1981 and is also considering submitting an application for transfer to an urban teaching position for 1981. The IMP teacher knows the Andra

vernacular, which is closely related to her native Hus language, and she uses it in everyday discourse with Andra people. She speaks English most often with her first graders, but switches into Pidgin and the vernacular for the introduction or explanation of difficult concepts or vocabulary items. The language switches seem very smooth, and the IMP teacher appears to have a good sense of when the students understand, and when it is necessary to re- explain in another language. From my observation of her Grade 1 classes and of the Grade 4 and 6 maths lessons, I was very impressed with her teaching style. She is warm toward the children, and appears to enjoy being a teacher and being with her students. Her room is brightly and profusely decorated with student art work, and her students work hard on crafts and singing, as well as on reading and writing. (The Grade 1 students were just beginning maths during Term 3.) The IMP teacher puts into practice many of the innovations she learned in her teacher training courses, such as kinesic, perceptual and structural approaches to reading. Her lessons are very well organized. Generally, lesson instruction begins with teacher directed whole-class activities followed by either individual or group work. In general she seems most comfortable in a teacher-directed learning setting, and she is very effective using this method.

Experimental Classes--ANDRA

	Boys	Girls	Total	x Age
Grade 4	15	7	22	11.95
Grade 6	14	15	29	13.31
Total	29	22	51	12.63

Notes:

1. There is no Grade 2 at Andra Community School in 1980.
2. There are no control classes at Andra Community School.
3. One girl in Grade 6 dropped out of school during the fourth week of the IMP trialling period. She is not included in these statistics.
4. All Grade 4 and Grade 6 students participated in the IMP study.

Subjects Assessed--ANDRA

GRADE LEVEL	PMAT 2	TAS 1	COG	PMAT 3	TAS 2
Grade 4	22	22	12	22	21
Grade 6	30	30	15	29	29
Total	52	52	27	51	50

Notes:

1. PMAT 2 and TAS 1 totals include one Grade 6 girl who dropped out of school during the fourth week of the IMP trialling period.
2. One Grade 4 boy was absent from school during TAS 2.
3. All Grade 4 students not previously tested were given COG; 15 of 20 previously untested Grade 6 students were randomly selected for COG.
4. Two Grade 6 students (Halas, Yohang) were absent from school for PMAT 2. They were subsequently administered these tests individually.

CURRICULUM IMPLEMENTATION

Difficulties in Documentation I had little difficulty taking notes during the lessons, mostly because the IMP teacher was very well organized, and her lessons proceeded generally as she had planned. However I was not able to write the observations neatly or completely enough in real time. Thus the major problem associated with documenting curriculum implementation was finding time to record and complete the notes. One solution to this problem might be the creation of forms, which include category headings, to be completed during the lessons, with a final section for afterthoughts or

post-lesson summary comments.

Teacher Questions and Comments

The IMP teacher and I met routinely in the evening to discuss that day's lessons and to plan for the next day's ones. Two issues arose with some frequency in our discussions: 1) what to do when one lacks the materials that seem to be "required" by the teacher's notes (materials such as scissors, kaukau, etc) and 2) how to deal with the uneven length and varying levels of difficulty of the lessons. To this teacher some of the lessons required a great deal of copying time (since the workbooks were not consumable), and others specified multiple activities (explanation, manipulation of base-10 materials, and written work), all of which required more than 30 minutes. Other lessons, such the playing card exercises, were seen by the IMP teacher as too easy and too short (but interesting to the students.) The IMP teacher wanted more direction on the Grade 6 materials, and remarked that she would have found the lessons more easy to teach if there had been explanatory materials for these lessons as there were for the Grades 2 and 4 lessons. Especially in the beginning of the trialling period, we spent alot of time deciding what materials to use, and how to substitute for those things not available on Andra. The IMP teacher had to be dissuaded of the notion that she would be doing the lessons incorrectly if she substituted materials or changed or adapted the activities to the skill level of the students. After these issues were clarified, she had little difficulty "making do" and modifying the lessons, both in the planning stage and during implementation. Modifications in the Teacher's Notes that may alleviate this problem include the highlighting of "materials needed" for each lessons, a general

introduction to "making do" at the beginning of the notes, and suggestions for alternative, equivalent materials for each lesson.

Implementation Problems

Generally the IMP teacher was very successful in her implementation of the lessons. One problem that we often discussed was the length of the lessons. She split only one lesson between two class periods. The rest we either reduced in scope beforehand, or more often, the maths lessons lasted 40-45 minutes. If the slower students were still working on problems 40 minutes into the class period, the IMP teacher stopped them and began summary, problem correction and review. Especially in the Grade 6 lessons, students often would be still working out the problems at their seats, while others were putting the solutions on the board. Although the IMP teacher did not consider workbook use as an implementation problem, the fact that she had the students use the workbooks so infrequently is an issue that IMP must address. She felt that the workbooks were too fragile and too distracting to be handed out during class periods. Student would, she felt, ruin them or flip though them and not pay attention to her explanations of the lessons. Therefore, the IMP teacher labouriously copied the examples and problems on the blackboard for presentation to he class. A few introductory remarks in the teacher's notes about the expected lifespan of the workbooks, and ways to familiarize students with them would be helpful. The ideal solution, of course, would be consumable workbooks or ditto masters (and working duplicating machines) for the teachers.

Grade 4 Instructional Activities

Attribute sorting, using the kina cards, was the most successful classroom activity. Both teacher and student interest was high. Students particularly liked manipulation of the objects, by dividing them among boxes or guiding them through mazes. The lessons were of the appropriate length and difficulty. The students could be seen to be acquiring the concepts during the lessons, with those catching on quickly helping those who were not. By drawing the two by two tables or mazes on the floor, the teacher was able to demonstrate the lesson to the whole class before dividing the students up into small groups. The small group activity was perceived by the students to be a competitive one, and interest ran high throughout the class period.

The use of the forward and backward clocks to introduce logical manipulations was less successful. The problems encountered in this lesson highlight the need for expanded teacher notes. For each lesson the IMP teacher tried to devise attention getting introductions. For the most part these were successful, both in her grasp of the main points of the lesson and in the interest that the introductions generated among the students. With no instruction from the teacher notes as to the purpose of the lessons, the IMP teacher decided that the lessons were exercises in counting (although she could not see why such a lesson would be in the fourth grade curriculum). Therefore she had the students clap and count together, and clap as a way of counting out the passage of time as the introductory exercise. This creative talent for devising and modifying curricula need not be wasted in this way if the teacher notes gave more information about the rationale behind the lesson.

I gave two lessons on measurement for the Grade 4 students while the

IMP teacher was detained off-island for a few days. The students enjoyed learning to use the metresticks and trundle wheels, and with great interest measured off the school yard, the dimensions of the school building, and the individual classrooms. Estimation tasks were attempted, and then tested through measurement, using the sticks or wheels. Small groups were organized to measure out the island itself--length, width and circumference. Adults in the community became involved in the exercise--calling out encouragements to the children, speculating on the size of the island, examining the trundle wheels, and pointing out the dividing lines between villages.

The fraction lessons were of mixed success. Students seem to have little difficulty making fractions of a set or in recognizing fractional parts of a whole. Where some confusion arose was in dividing wholes into fractional parts. The distinction between two (or three or four) parts and two (or three or four) <u>equal</u> parts was often not made. Students would sometimes, especially on the more unusual figures, divide the area into the correct number of parts, but of quite unequal size. Reminding teachers in the notes that this might occur and that they should stress the difference between parts and equal parts would be helpful. The IMP teacher did some of this herself by describing the exercises in terms of dividing up valued items (usually food) among friends. Also it should not be assumed that the teachers know the correct way to divide up figures into equal parts. Answers should be included in the teacher notes.

Students caught onto the idea of number stories and multiplication facts using the squared paper, but there was not enough drill for many of the students. Lesson 149C on the both-ways rule had problems at the end that could not be solved without already knowing the multiplication facts. The IMP teacher could not figure out a way for groups of students

to construct multiplication tables (no scissors, few straight edges) so she revised the lesson such that students could fill in multiplication tables sharing the one set of number story blocks that she had constructed at the in-service. Pairs of students filled in the multiplication table, by laying on the number story blocks that were passed around the classroom. This strategy was fairly successful in getting the students to apply the both-ways rule and to see where multiplication facts come from. Addition using base-10 materials went smoothly; subtraction went less well. For one thing, there was no explanation of how to do subtraction with base-10 materials in the Grade 4 teacher notes. The IMP teacher had to refer back to the Grade 6 book for this information. Secondly, the subtraction lesson came at the very end of the trialling period when students, teacher and researcher all were winding down.

Grade 6 Instructional Activities

The first few lessons on counting systems were easy for the students at Andra and could have included more materials on differing bases. The Grade 6 students learned quickly to manipulate the base-10 materials and to carry out number problems using squared paper. The top students were often given extra problems to work out while the rest of the class continued to complete the class assignment. The base-10 material manipulations were done in pairs, an especially effective organization if students of different ability are paired together. The game activities were great successes--the competitive nature of the dice and board games generated high levels of interest and involvement among the students. Multiplication facts remained a problem for some of the students. Perhaps more activities, especially game-like ones, to aid in this activity would be useful. The curriculum materials for Grade 6 seemed of quite uneven

length. Some of the lessons could be completed in less than 30 minutes; others would have taken over an hour if all the suggested activities were carried out.

Teacher Notes

The Grade 4 Teacher Notes formed the basis for lesson planning for the IMP teacher. She found the numbered steps approach clear and useful. The list of materials needed for the lesson is a very useful section, but should either be expanded to include alternate equivalent materials, or should be prefaced by a discussion of how to find equivalent materials if the materials listed are not available in the area. In the beginning of the trialling period, the lack of availablity of the materials needed was discouraging and unnecessarily anxiety-provoking to the IMP teacher. Some explanatory notes would have helped here. The IMP teacher found the Grade 6 lessons to be more difficult to prepare, and she often mentioned how helpful it would have been to her to have some separate teacher instructions for the Grade 6 lessons. For both the Grade 4 and Grade 6 lessons, the Teacher Notes should contain the correct answers to the problems. Several lessons were marred by this omission. I would recommend putting the answers in the back of the book, or at least separate from the initial presentation of the problems. The process of trying to work out the problems that the students would face the next day helped the IMP teacher see problems that would arise, or confusions of her own. The graphics of the workbooks were very good; students found them clear and compelling. The construction of the workbooks caused complications on Andra. The IMP teacher considered the workbooks too fragile to be used daily. Therefore she did not regularly hand out the books to the students but rather copied the problems on the board, a rather tedious task.

The workbooks need to be made more sturdy if they are to remain non-consumable; otherwise teachers may refrain from using them for fear that the workbooks will not last a number of years. More information directed to the teacher would be a valuable addition to the teacher notes. Teachers need to know (and should not be assumed to already know) the rationale for each of the lessons. Only by knowing clearly what the curriculum planner had in mind when constructing the lessons will the teachers be able to more easily adapt and adopt the curriculum. Without such information, teachers may have to rigidly follow the lesson plan for fear of missing the "point" or may become discouraged by the lack of materials or lack of skills among the students, and give up trying to implement the curriculum altogether. Teachers not only need to know but have the right to know what the goals of the curriculum planner are. Only by a sharing this knowledge, will the aims of the curriculum planner find their way into the activities of the classroom.

Learning Aids

Students found the base-10 materials easy to handle. The materials seemed very useful in conveying the underlying concepts in number operations. Cutting out these materials was a time-consuming activity. The kina cards were a great all round success--easy to assemble, attractive to the students and helpful in teaching attribute sorting. The coin cards were used only in one Grade 4 lesson (149H). The students liked working with the coins very much, and were reluctant to give them up at the end the lesson. As one of the people who spent time punching out the cards and assembling them into packets, I strongly recommend choosing another color or process to represent silver coins. The paint came off very easily and the coins became quite messy to handle. The measurement devices were used in two Grade 4 lessons. Rulers were in very low

supply at Andra Community School, and students enjoyed using the rulers and metresticks as well as the trundle wheel. Students were very motivated to use the materials; I strongly recommend continuing their use. Another big success were the playing cards and the games with dice. These Grade 6 lessons were among the most exciting and enjoyable to the students. The students at Andra seem to find competitive activities quite compelling; thus for a school like Andra, additional games for use in learning mathematical concepts would be quite successful.

Curriculum Implementation--ANDRA

	Lesson Codes	Detailed	Total
Grade 4	144A, 144C, 144D, 145A, 146A, 149A, 149B, 149H, 164A, 164B	11	22
Grade 6	6-1,6-5, 6-11, 6-12, 6-13, 6-16, 6-17, 6-18, 6-22, 6-24	10	22

Overall Conclusions

The combination of workbooks and learning aids worked very effectively. Students were interested in and motivated by the various learning aids. The IMP teacher was able to follow and generally to adapt the lessons for her students, given her in-service training and the teacher notes. Judging from the questions that arose in the discussions of the Grade 6 lessons, I would recommend that teacher notes be made available for all the lessons for every grade. Otherwise there is a risk of a misunderstood lesson goal, a discouraged teacher or a by-the-books teaching of lessons. The workbooks need to be either consumable or somewhat revised toward the understanding that students will

need time to copy over problems into their own notebooks. The required copy time made some of the lessons inordinately long. The use of some of the learning aids, in particular the base-10 materials, seem to require an in-service. The Andra teachers felt competent to give such a course, and they expressed a willingness to share their knowledge with their fellow teachers. To be most effective, the curriculum should be accompanied by extensive teacher information. These instructions might be organized in the form of short tutorials for the teacher, which would preceed each major instructional section of the curriculum. Of course, the most efficient way in which to institute a new mathematics curriculum is to teach such a curriculum to the students at the teacher colleges. However, for teachers currently in the classroom, more information and aid are needed for the effective introduction of a curriculum like this one. In-services could be an important part of this aid. Just as valuable, however, would be clear descriptions of the goals of the curriculum planner, so that teachers know not only how to teach a given lesson but why to teach the lesson in that particular way.

LANGUAGE USE

Difficulties in Documentation

Little language switching out of English occurred in the fourth and sixth grade classrooms; English was the language of instruction almost all of the time. At first I used the language use forms to follow the changing speech events, but later I began taping the language lessons because I thought that they would prove rich for analysis of speech events, apart from language switching. One problem with using a form alone, without taping, for recording language switching is that when switching did occur, it usually happened too suddenly and too briefly to document well. I would recommend combining the

language use and the classroom interaction forms into one real-time coding form, and tape the lessons as well, for further analysis. Instructions to observers to watch for and to record language switches could be built into the general classroom observational notes for curriculum implementation. With these notes, one can get an idea of the proportion of language switching across sites, and some preliminary notions of the contexts of the language shifts. In summary, the language use form fell in an unsatisfactory middle; if there were no shifts in language, the form was inadequate for recording other speech events, and if much switching occurred, the observer had too much difficulty recording them all in real-time with such a form.

Language-Use Lessons: ANDRA

	Lesson Codes	Total
Grade 4	144B, 145B, 146C,149C*	4
Grade 6	6-2, 6-6, 6-34*	3

NOTE: *=audiotaped

Summary

Language switching from English to Pidgin English to Andra vernacular was very infrequent in the mathemetics lessons of Grades 4 and 6. Outside of mathematics, administrative talk by the teacher was often in Pidgin, as were the lessons in Christian education. Other than in these classes and contexts, the language of the classroom was English. There are a few instances in the taped recorded lessons that one hears Pidgin being used administratively (Hariap=hurry up; pinis?=finished?). The only time I heard the IMP teacher use tok ples during the mathematics lessons (apart from the Grade 6 lessons on indigenous counting systems) was in a Grade 4 lesson on multiplication and division word problems using money (149H). The IMP teacher had unwittingly

changed the problem midstream which confused the students such that no one answered the question correctly. After several attempts at eliciting the correct response using English, she switched to both Pidgin English and to tok ples. In addition, she personalized the problem to the world of the children ("If your mother had too many fish...").

When students spoke with each other, during small group activities for example, they used a mixture of all three languages. Numbers were most often spoken in English (although the vernacular counting system is known by all the students and is used in daily life). Turn-taking talk or comments on another's performance sometimes was in Pidgin English or in vernacular. In response to the teacher's questions, the students tended to follow the lead of the teacher. When she asked a question in English, they responded in English. When she asked a question in Pidgin English, they responded in Pidgin English.

In summary, the IMP teacher switched out of English only very infrequently with the Grade 4 and 6 students. With her own class of Grade 1 students, she moved from English to Pidgin English to vernacular often and easily. From informal observations, the students seemed to follow her at most times, and the switching into vernacular appeared to occur at the introduction of new materials, for most administrative talk, and at points of student confusion. Pidgin English was less often used than vernacular with the Grade 1 students as they appeared to be (and were thought by the teacher to be) not fully fluent in Pidgin English yet. From the point of view of language switching, the Grade 1 classes looked much more interesting than either Grade 4 or Grade 6; thus, I assume that the Grade 2 at the other sites provided more rich data than the other two grade levels in this regard. In addition, I think it would be fascinating to contrast a class such as the Grade 1 at Andra (where the teacher and the students all spoke the same vernacular) to a class

in which the teacher did not speak the students' tok ples to one in which the teacher did share tok ples but school rules forbid its use, to a class in which students did not have a common language (perhaps an immigrant urban area).

CLASSROOM INTERACTION

Difficulties in Documentation The most difficult note taking in the classroom involved classroom interaction. After some initial attempts at recording speaker change during the course of the lesson. I simply let the tape run and recorded (with reference to the counter number) non-verbal aspects of the interaction, and evaluation techniques. I tried to transcribe the first tape, but speaker change occurred so frequently that the task proved just too time consuming. The speech of the IMP teacher and of the students was clear enough on the tapes (and students either answered in unison or were called by name) that I felt that the transcribing at a later date would not prove too difficult to do, even without an initial transcript. The only tapes that will be difficult to determine the details of interaction from are those which involve loud group activities, such as dice throwing. While the field guide allowed for various organizations of the lessons (teacher--whole class, small group, etc.), there were no instructions as to taping procedures to follow when the different organizations were in use. Since the Andra classes were generally characterized by teacher directed whole-class activity during the initial instructional period, this did not prove to be a problem until students began their individual seat work. Instructions in the field guide as to where to place the microphone during these periods would have been helpful. Following one student through the seat work (when the teacher often made rounds and gave individual help) may have given useful data. In addition,

during the lessons which were organized as small group activities, the microphone had to be placed in one of the groups, but there was no guidance from the field guide for criteria for choosing the group.

Audiotaped Classroom Interaction Lessons--ANDRA

	Lesson Codes	Total
Grade 4	144E/F*, 145C, 146D	4
Grade 6	6-3, 6-7, 6-9, 6-21, 6-28	5

*=combined into one lesson

NOTE: In addition, the following lessons were audiotaped: 149C, 149G, 149H, 164A, 164B, 6-22, 6-24,6-34.

Summary of Classroom Interaction

While more complete analysis must await the transcription of the audiotapes, some preliminary findings can be presented here. The IMP teacher at Andra seemed to feel most comfortable instructing in teacher-directed interaction, in which class talk was organized T-Cl or T-S, with very frequent changes of speaker. Particularly with the Grade 4 class, which the IMP teacher had taught the previous three years, the classroom interaction for instruction consisted of very strictly teacher-structured dialogues, with a strong joint performance quality about them.

For the activity part of the lesson, she used either individual, pairs, or with Grade 4 students, small group activities. At the end of an instructional session, students were routinely asked if they had any questions. This question, which served as a transitional marker from instruction to activity, never elicited any questions on the part of students. Generally students only infrequently asked questions of the teacher, and they initiated interaction with her only in administrative matters, (e.g. they did

not receive their workbook) and even then with reluctance. Students responded to the teacher's questions very enthusiastically; the lessons were punctuated with shouts of "I,I,I" accompanied by hand waving.

Evaluation of a student's work in the IMP classes was generally informal and private. During the entire IMP period no tests were given in mathematics (other than PMATs), nor was the students' written work systematically evaluated. Only once during the trialling period were the students' papers marked. In the Grade 4 lesson on dividing whole objects into fractional pieces, the teacher looked at each student's work, checked it and initialed it "very good". Several errors went undetected; all papers were marked as all correct. More often evaluation was informal. The IMP teacher would walk around the room during the activity part of the lesson and work with individual students on the problems that she noticed them having. At the end of each activity period, the students' written work was collected. Only then were the solutions to the problems put on the blackboard. Thus students had no opportunity to check their own work against the correct solutions on the board. Student written work was not corrected, nor was it handed back to students. In addition, the IMP teacher did not use the students' written work very consistently to give herself feedback on how students were doing. Rather she tended to rely on student responses during the lesson and their work in progress, that she looked over while they worked at their seats, to determine if the lesson was being understood by the students. During our debriefing sessions, we looked through the students' written work together. My impression was that this was not a normal part of her lesson planning, since she did not seem to know quite what to do with the information contained in their work. When consistent errors were evident in the written work, the IMP teacher did incorporate a review of these points in her next lesson. No grades were posted in any of the classrooms, nor was the relative rankings of students made

public by the teachers.

During class discussion, the IMP teacher did not often follow students responses with either positive or negative evaluations as such, but rather a correct response was followed by a repeat of the question to the entire class, and an implicit request to chorus the answer. An incorrect answer produced varied reactions--a repeat of the incorrect answer in a questioning intonation, asking the class,"Is that correct?" or ignoring the answer. The only student who consistently received positive evaluation following correct answers was a Grade 4 student whom the teacher considered to be learning disabled.

STUDENT INTERVIEWS

Difficulties in Conducting and Documenting Student Interviews

The student interviews might have been richer had the research team spent more time beforehand discussing what we wanted to find out from the students beyond simply their comprehension of the lesson. Perhaps a list of tasks or questions to be covered during the session (as were set out for the teacher interviews) would have led to more information and greater comparability of student learning across sites. The interviews were not complicated on Andra by communication problems, as the fourth and sixth graders were fluent in English. Occasionally, shyness would inhibit one of the fourth graders, but this was not a serious problem. After some discussion with various of the students in each class, I settled on one top student and one student who seemed to be having problems with the particular lesson, to be interviewed. The major difficulty with the student interviews was not knowing how to proceed after going through the lesson to assess understanding. Perhaps my

lack of familiarity with primary mathematics curriculum and with mathematics learning in general led to this predicament. Whatever the reason, I felt that although the student interviews had the potential for being rich sources of data, I was unable to go much beyond assessment of understanding.

Student Interviews--ANDRA

	Lesson Codes	Total
Grade 4	144F, 145D, 146B, 149D	4
Grade 6	6-4, 6-8, 6-10, 6-20	4

Summary of Student Interviews

Two students from Grade 4 and Grade 6 were interviewed following four of their lessons. I found the Grade 6 interviews to be fairly straightforward reviews of the lesson; there did not seem to be much to "discuss" about many of these lessons. The Grade 4 interviews generated more discussion, but as with the Grade 6 lessons, the discussions were limited somewhat by my lack of background in mathematics education. The student interviews confirmed my classroom observations that the lessons were not understood by all of the students. Particularly in Grade 6 the students who were "slower" (as judged by the teacher) often did not understand the lessons very well at all. The "top" students were able to repeat their performance on the lesson as well as correctly complete examples generated from the principles of the lesson. The "slower" students most often could not even repeat their previous work. There never seemed to be enough time in the mathematics lessons for the "slower" students to get through all of the problems, or to understand and correct their mistakes. The progressive falling back of students who do not catch on to the materials quickly was clearly evident in the interviews with the "slower" students.

SUMMARY

Andra Community School is located on a small island several hours by outrigger canoe from Lorengau, the administrative headquarters of Manus Province. While geographically isolated, the people of Manus have a long history of and interest in contact with the outside world. Andra people who stay on the island are subsistence and trading fisherfolk. Those who leave have achieved high levels of success in the modern economic and political world of Papua New Guinea. Many Andra Islanders, as have Manusians generally, have gained positions in government, in industry and in education. Despite these successes in the modern world, Andra people who live on the island retain many aspects of traditional culture. The vernacular language of Andra is spoken by all Andra people and is used in everyday discourse. Pidgin English is learned by all, and is used in negotiations at the marketplace and in the church. English is acquired with some fluency by all who attend school. The Andra community is committed to the formal education of its children. With only a few exceptions, all children attend school for at least six years, and most parents hope that their children can continue on for more years of schooling at secondary or vocational schools.

Both the teacher and the students found the curriculum materials to be attractive and exciting. The teacher notes for Grade 4 were very useful to the IMP teacher, and with few exceptions, were complete enough for her to expand/adapt to her students. There were two major problems with the Grade 6 materials: the lack of teacher notes, and the low level of some of the materials. The IMP teacher often commented that some instruction on how to present the materials to the Grade 6 students would have been of great help to her. With no separate teacher notes, she tended to be more tied into the text

of the student workbook, presenting each problem in order. The Grade 6 students generally had little difficulty with their lessons (except for some students who did not know their multiplication facts). This may be due in part to the presentation of the materials and in part to the missing term 2 syllabus which forced the regular Grade 6 teacher to go over the term 3 materials earlier in the school year. The manipulative materials were a great success with the students. They took care not to spoil the base-10 materials, the cardboard coins or the kina cards; thus, these should last quite a while. The workbooks were only infrequently handled by the students. Rather the work was copied by the teacher onto the board, and by the students into their workbooks. This practice, instituted by the IMP teacher, made for a great deal of extra copy work for her, but she was determined to organize her lessons this way in order to 1) reduce wear on the workbooks and 2) retain student attention to her explanations of the materials.

Mathematics lessons at Andra Community School were conducted almost entirely in English. Occasionally the IMP teacher switched into Pidgin English or more rarely into the local vernacular language to convey material that she thought was particularly difficult, or for administrative direction. The students almost always responded in English, but spoke among themselves when in small groups in a mixture of English, Pidgin English and vernacular. The organization of the classroom interaction changed with the phase of the lesson. During the instructional phase the interaction was strongly teacher directed, whole class in nature. During the activity phase, the students worked alone, in pairs or in small groups, as the lessons called for these groupings. The IMP teacher spent time with each group as they worked. Finally, the class was called back together for problem correction, review, and collection of materials. The student interviews revealed a range of understanding among the students after the lessons. These discussions seemed

to confirm that the teacher aimed the lessons such that most students understood, but that she did not postpone the next lesson until all students understood. Great effort was made by the teacher during the activity period to help those who seemed confused, but the class had a single pace, and those who could not keep up with the majority of the class, fell behind. From my observations of the trialling of IMP materials at Andra Community School, I have several suggestions for improving materials, pedagogy and teacher training. More use might be made of the manipulative materials, given their successful introduction during the IMP trialling period. Optional activities and games might be presented to teachers for use with students who need additional practice in number operations or multiplication facts, for example. The length of lessons was quite uneven in Grade 4 and Grade 6 lessons; the lesson which require instruction, manipulation of base-10 materials, and squared-paper work should be broken down into two shorter lessons. The correct answers to all problems should be available to the teacher in the teacher notes. More effort should be spent in teaching students to recognize the number operations relevant to word problems. Recognizing that a given problem was a division or a multiplication problem was one of the tasks that Andra students found difficult to complete correctly. The success of this mathematics curriculum, as most courses of study, requires that the teacher be able to evaluate student progress. More explicit training of teachers in the various methods, both formal and informal, written and oral, of evaluating student understanding would improve the teaching of lessons such as these. A key to the success of the trialling of the IMP materials at Andra was the willingness of the teacher to experiment with various ways of conducting classroom activities, such as using games, or having students work in pairs or in small groups. Any teacher training activities which not only encourage but also assist teachers in developing a variety of different methods appropriate

in introducing new materials can not help but improve the quality of teaching in the community schools. Andra Community School has bright, motivated, and attentive students. It also has intelligent and dedicated teachers who are well-integrated into the local community. The people on Andra are strongly committed to the education of their children, and community leaders work closely with teachers to ensure the smooth operation of the school. The school is nonetheless geographically isolated, and teaching materials and school supplies are often inadequate or out-of-date. The quality of mathematics education would be improved in a community school like the one on Andra if a continuing and adequate supply of materials found their way into the school. Both labour-saving devices, like duplicating machines, and more student equipment, such as pencils and rulers, would make teaching and learning at Andra Community School that much more successful.

INDIGENOUS MATHEMATICS PROJECT

WORKING PAPER SERIES

1. Learning to Compute.
   R. Souviney, January 1980.

2. Strategies for Mathematical Problem Solving.
   R. Souviney, March 1980.

3. Assessment Administration Guide.
   R. Souviney, April 1980.

4. Field Guide for Studying Classroom Events and Their Cultural Context.
   P. Levin, M. Gearhart and R. Souviney, June 1980.

5. International Congress on Mathematics Education.
   R. Souviney, V. Kada and D. Malaga; D. Lancy; M. Britt; B. Roberts, August 1980.

6. Andra Community School Field Report.
   P. Levin, November 1980.

7. Ororo Community School Field Report.
   J. Lineberger, November 1980.

8. Divanap Community School Field Report.
   M. Gearhart, November 1980.

9. Kero Community School Field Report.
   K. Johnson, November 1980.

10. Muglamp Community School Field Report.
    B. Rowe, November 1980.

11. Teachers Notes and Student Worksheets – Grade 2. 1980.

12. Teachers Notes and Student Worksheets – Grade 4. 1980.

13. Teachers and Students Text – Grade 6. 1980.

14. The Changing Form of Numerical Reasoning Among the Oksapmin.
    G. Saxe, January 1981.

15. Intra-Cultural Variation in Cognitive Development – Conservation of Length Among the Imbonggu.
    D. Lancy, R. Souviney, V. Kada, February 1981.

16. The Education of Atawe.
    M. Clements and P. Jones, March 1981.

17. Influences on Mathematical Learning in Papua New Guinea – Some Crosscultural Perspectives.
    M. Clements and G. Lean, May 1981.

18. Teaching Community School Mathematics – A Comparison of Five Sites.
    B. Miller-Souviney, June 1981.

19. Classroom Maths Games.
    IMP Staff, June 1981.

20. Teaching and Learning Mathematics in the Community Schools of Papua New Guinea.
    R. Souviney, July 1981.